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## PATENT ABSTRACTS OF JAPAN

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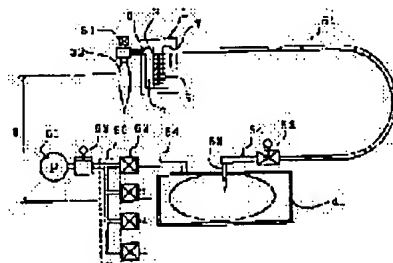
(72)Inventor : **KUMAGAI TOSHIO**

### (54) INK JET RECORDING APPARATUS AND VALVE MECHANISM

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a highly reliable ink jet recording apparatus by preventing trouble such as the fixing of a sub-tank film or the clogging of a passage even when a circulating type ink jet recording apparatus is allowed to stand over a long period of time.

SOLUTION: A flexible supply tube 51 is connected to the ink supply port 7 on the side of a cartridge 41 and a passage valve 52 being a valve means is connected to the other end of the supply tube 51. The passage valve 52 is further connected to an ink cartridge 41 through a tube 54 and a tubular needle 53. An air pump 61 serving as an ink supply means is branched into four systems through a pressure regulator 62 to be connected to the ink cartridge 41 from changeover valves 63 through air pipes 64.



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CLAIMS

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[Claim(s)]

[Claim 1] Two common ink rooms which are open for free passage on both sides of a pressure generating room. It is each the ink cartridge which carries an ink-jet formula recording head and a sub tank equipped with the ink feed hopper linked to the exterior in carriage, and is connected with the aforementioned ink-jet formula recording head by passage out of the aforementioned carriage to the ink room of each aforementioned community. An ink supply means to feed the ink of the aforementioned ink cartridge. It is the ink-jet recording device equipped with the above, and is characterized by having a bulb means between a recording head and an ink cartridge.

[Claim 2] The ink-jet recording device according to claim 1 to which the aforementioned bulb means is characterized by being a normal closing type solenoid valve.

[Claim 3] The ink-jet recording device according to claim 1 to which the aforementioned bulb means is characterized by operating according to the pressure of an ink supply means to feed ink.

[Claim 4] The valve mechanism of the ink-jet recording device according to claim 3 characterized by having the valve portion material which an ink supply means to feed the aforementioned ink is an air pump, and was arranged in the interior of the passage between the diaphragm connected with the aforementioned air pump in passage, and a recording head and an ink cartridge, interlocking with [ variation rate / of the aforementioned diaphragm ] the aforementioned valve portion material, and displacing.

[Claim 5] The valve mechanism according to claim 4 characterized by arranging two or more valve portion material to a single diaphragm.

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**DETAILED DESCRIPTION**

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**[Detailed Description of the Invention]**

[0001]

[The technical field to which invention belongs] this invention relates to the recording device which carries the ink-jet head which breathes out an ink drop and is made to adhere in the record paper, only when record is needed.

[0002] It is concerned with the ink-jet recording device of the circuit system which records while supplying ink to a sub tank and a recording head through passage from the ink cartridge which carried the ink-jet formula recording head and the sub tank in carriage, and was installed in the box in more detail.

[0003]

[Description of the Prior Art] An ink-jet recording device carrying in carriage the ink-jet formula recording head which carries out the regurgitation of the ink drop by the pressure generating means, and printing receiving supply of ink from an ink tank, also carrying an ink cartridge in the carriage equipped with the recording head, and attaining simplification of structure is performed.

[0004] In order for dot density to become large by leaps and bounds with improvement in the performance of an ink-jet formula recording head, to, attain color printing by natural color on the other hand and to aim at improvement in much more printing quality, efforts to make the blot on a record medium small as much as possible are made.

[0005] Methods, such as heating and carrying out film formation of the emulsion which becomes ink from thermoplastics as the one means, and the ink which was made to contain sugar and was breathed out on a record medium, are proposed.

[0006] If it is in ink equipped with such film formation nature Since melting fixing of the emulsion in ink is carried out by heating in addition to the merit that quality of image improves sharply since there are very few blots, while it has the merit that advanced water resistance is obtained, in order the concentration of the solid content under ink composition is high and to receive the thermal effect from a heating means further -- viscosity elevation of ink -- or it is easy to produce the unstable regurgitation by gassing accompanying a temperature up etc.

[0007] Although connecting a recording head, a sub tank, and an ink cartridge to endless, and circulating through ink as a method of canceling such a trouble is also proposed, since two passage of the passage for outward trips and the passage for return trips is needed between a recording head and an ink cartridge, it has the problem that passage structure becomes complicated. Two common ink rooms which these people etc. open for free passage on both sides of the pressure room of a recording head, It has the ink feed hopper by which ink flows into the ink room of each community from the exterior, respectively. One ink feed hopper is connected to a sub tank, and the ink feed hopper of another side is connected to the ink cartridge. Make it go via an ink-jet formula recording head by the supply means of the ink which feeds the ink of an ink cartridge, and ink is pumped up on a sub tank. Moreover, the ink-jet recording device which was made to print while circulating through ink to an ink cartridge and making the interior of an adverse current, now a recording head circulate through ink via a sub tank to a recording head was proposed.

[0008] According to this, without causing complication of structure, the temperature up of the viscosity elevation by the recording head or a recording head can be prevented as much as possible, and stable record can be performed.

[0009]

[Problem(s) to be Solved by the Invention] Since it can be circulated through a sub tank by constituting with a flexible film, without foaming also by vibration of the carriage further accompanying [ there is very little pressure fluctuation and ] record operation, it has the outstanding merit that record stabilized more can be performed.

[0010] However, in a non-operating condition, the ink in a sub tank will be in the state where films stuck through few ink layers in order to all flow backwards to an ink cartridge side according to a gravity difference. The technical problem that the ink of passage until elevation of the concentration of the solid content in remaining ink is remarkable when moisture evaporates through the aforementioned flexible film in neglect prolonged in this state etc., and films fix or it results [ from a sub tank ] in a head solidifies, and obstacles, such as jam up \*\*\*\*, arise occurs.

[0011] The place which this invention is made in view of such a technical problem, and is made into the purpose is offering the ink-jet recording device which an obstacle's does not produce by prolonged neglect, either by making ink remain in a sub tank also in the state where it does not work.

[0012]

[Means for Solving the Problem] Therefore, two common ink rooms which are open for free passage on both sides of a pressure generating room in this invention, The ink-jet formula recording head and sub tank which equipped the ink room of each aforementioned community with the ink feed hopper which connects with the exterior, respectively are carried in carriage. Moreover, it sets to the ink-jet recording device which comes to prepare the ink cartridge connected with the aforementioned

ink-jet formula recording head by passage, and an ink supply means to feed the ink of the aforementioned ink cartridge, out of the aforementioned carriage. It is characterized by having a bulb means between a recording head and an ink cartridge.

[0013] Moreover, the aforementioned bulb means is characterized by being a normal closing type solenoid valve.

[0014] Moreover, the aforementioned bulb means is characterized by operating according to the pressure of an ink supply means to feed ink.

[0015] Furthermore, in a valve mechanism, an ink supply means to feed the aforementioned ink is an air pump, and it has the valve portion material arranged in the interior of the passage between the diaphragm connected with the aforementioned air pump in passage, and a recording head and an ink cartridge, and is characterized by interlocking with [ variation rate / of the aforementioned diaphragm ] the aforementioned valve portion material, and displacing.

[0016] Furthermore, the above-mentioned valve mechanism is characterized by arranging two or more valve portion material to a single diaphragm.

[0017]

[Embodiments of the Invention] Hereafter, the first example of this invention is explained using a drawing.

[0018] Drawing 1 shows the passage composition of the ink-jet recording device of this invention, and drawing 2 shows the structure of the ink-jet recording device of this invention. Moreover, drawing 3 and drawing 4 show structural drawing of a sub tank portion and an ink cartridge portion used for this invention, respectively.

[0019] In drawing 2, a recording head 1 and the sub tank unit 30 are stopped on carriage 2, and perform a both-way scan by the driving means which are not illustrated (horizontal scanning). The platen 10 arranged in the position which counters a recording head 1 on the other hand rotates by the driving means which are not illustrated, and, on the other hand, conveys in a direction the recording paper 12 which is a record medium (vertical scanning). Synchronizing with the above horizontal scanning and vertical scanning, based on record data, breathe out an ink drop, it is made to adhere on the recording paper 12, and predetermined record is performed from a recording head 1.

[0020] Water resistance is given while the blot by space is prevented because the front face of the emulsion which is thermoplastics contained in ink fuses and combines the ink drop recorded on the recording paper 12 while the moisture in ink evaporates quickly in response to the heat supply from the platen 10 heated at the heater 11 which is a heating means.

[0021] In addition to cooling by the ventilating fan which is not illustrated, this heat is cooled by what is made for ink to flow to the recording head 1 interior (ink circulation) although heat transfer is carried out also to the recording head 1 which faces a platen 10 at this time.

[0022] Next, drawing 1 explains the passage composition of the ink-jet recording device of this invention. Although this example is the composition of performing color record using the ink of four colors, it is the composition of branching the air from a single air pump to four lines, and performing ink circulation for every system, and shows only one only of lines of it by drawing 1.

[0023] 32 is a sub tank and is connected to a recording head 1. The recording head 1 is equipped with the ink feed hoppers 6 and 7 by which ink flows into two common ink rooms 4 and 5 which are open for free passage on both sides of the pressure room 3, and the ink room of each community from the exterior, respectively. According to the pressure differential from which the ink feed hopper 7 of another side is connected to the sub tank 32 side again at an ink cartridge 41 side, and one ink feed hopper 6 produces ink between ink rooms, a flow (ink circulation) is made via a pressure room.

[0024] The flexible supply tube 51 is connected to the ink feed hopper 7 by the side of a cartridge 41, and the passage bulb 52 which is a bulb means is connected to the other end of the supply tube 51. Opening of traffic of passage is made by energization to an internal solenoid, and the passage bulb 52 of this example consists of the so-called normal closing type which has the property that passage is intercepted in the state of un-energizing of solenoid valve.

[0025] The passage bulb 52 is further connected to an ink cartridge 41 via a tube 54 and the tubular needle 53.

[0026] Via the pressure regulator 62, the air pump 61 which is an ink supply means branches to four lines, and is connected to an ink cartridge 41 via the air pipe 64 from the change bulb 63.

[0027] Next, record operation is explained and it explains to a detail further.

[0028] While performing energization to the passage bulb 52 and carrying out Kaisei of the passage on the occasion of the start of record operation, an air pump 61 is operated.

[0029] Circulation operation of ink is started based on the amount of ink in a sub tank henceforth.

[0030] The sub tank unit 30 shows the structure to drawing 3 by the exploded view. The sub tank 32 is made with the capacity adjustable using the flexible film. 141 is an ink full detector which detects the ink full of the sub tank 32, and 142 is an ink low detector which detects INKUEMPULI. Ink full is detected when the amount of [ of the detection board 140 which is the tabular spring object arranged so that ink full might meet the front face of the sub tank 32 ] point intercepts the optical axis of the ink full detector 141 which consists of a photoluminescence photo-detector pair. Moreover, when the ink low detector 142 constituted the optical axis of a photoluminescence photo-detector pair on both sides of the sub tank 32, the ink of the sub tank 32 interior which has light-transmission nature decreased in number and the quantity of light to penetrate increased, ink empty \*\*\*\*\* of [ in a sub tank ] is carried out.

[0031] When the ink full of a sub tank is detected, the energization to the change bulb 63 is turned off by the control circuit which is not illustrated. They are three so-called directional valves as for which the change bulb 63 is opened for free passage by the cartridge side with the atmosphere while opening of traffic with an air pump 61 is made by energization and an air pump side is intercepted at the time of un-energizing. Therefore, atmospheric pressure is opened for free passage to the ink cartridge connected.

[0032] An ink cartridge 41 is the structure where the ink bag 43 is held in the airtight box 42, and the air pipe 64 is connected to

the airport section of a box 42, as a cross section is shown in drawing 4. Therefore, if the interior of a box 42 becomes atmospheric pressure, since the ink in the ink bag 43 will become equal to atmospheric pressure as much as possible, it has the water head difference shown by H in drawing 1, and the ink in a sub tank flows backwards to a cartridge side via the inside of a recording head while being supplied to a recording head.

[0033] Next, when INKUEMPUTI of a sub tank is detected, the energization to the change bulb 63 is made, and the box 42 of an ink cartridge is opened for free passage with an air pump 61.

[0034] A pressure is adjusted so that ink may leak and it may not come out of the pressure from an air pump 61 by operation of the pressure regulator 62. Since the ink in the ink bag 43 is pressurized by this pressure, while the ink in the ink bag 43 is supplied to a recording head, it is pumped up via the inside of a recording head at a sub tank side.

[0035] Henceforth, ink circulation is made by repeating the above-mentioned operation successively during record operation.

[0036] The following operation is performed when a series of record operation is completed.

[0037] Energization to the change bulb 63 is performed first, ink is pumped up by the sub tank 32, when the ink full of a sub tank is detected, the energization to the passage bulb 52 is turned off, and the passage between a recording head and an ink cartridge is intercepted. Therefore, ink is stored inside the sub tank 32.

[0038] According to this, since ink sufficient in a sub tank remains also in prolonged future neglect, even if evaporation of the ink in a sub tank arises, a solid-content concentration rise is mitigated, and it is prevented effectively that blinding and films therefore fix.

[0039] Since passage is intercepted when a power supply is disconnected by the reason which is not power-failure-etc.-expected during record operation, since the passage bulb which is furthermore a bulb means consists of a normal closing type solenoid valve, operation that ink is held is in a sub tank.

[0040] Moreover, since the ink of the amount which corresponds in a sub tank at ink full is held when resuming record operation again, it also has the merit that record operation can be started immediately.

[0041] (others -- operation form) drawing 5 shows the passage composition of the ink-jet recording device of the second example of this invention, and shows the structure of a bulb means to drawing 6

[0042] It explains using a drawing below.

[0043] Drawing 6 (a) is the exploded view having shown the composition of the passage bulb 52 used for this example.

[0044] In an example, four passage is arranged in a single unit and same operation is performed about each system. 154 is a valve, is energized with a spring 153 in the state of usual, and is pressed by packing 154 while a part for a shank is supported by casing 156 possible [ a slide ]. Fixation of a spring 153 and the free wheel plate 151 with a tube 51 which has the role of connection are fixed to the upper part of casing 156. Moreover, an end connection with the tube 54 which leads to an ink cartridge side is constituted by the casing 156 lower part in one. The flexible film 157 is arranged by casing 156 lower opening so that path clearance (c shows to drawing 6 (b)) may be constituted to the operation shaft of a valve 154. Although a flexible film can also use rubber etc., in this example, the flexible film used the laminate film which joined the polyethylene film which is thermoplastics further to the film which deposited aluminum on the PET film. It is more effective, when according to this it can join to casing 157 by heat welding and transparency of moisture or air carries out invasion prevention further. Although the passage of ink is formed of the above, since ink flows more nearly up than a lower part as pressurization shows all over [ a ] drawing, in order that a gas may not remain inside the passage bulb 52, it is suitable. Under the plasticity film 157, it consists of rubber material, covering 159 is arranged through the diaphragm 158 with which the pressure-receiving section 161 was formed in one, and a chamber 160 is formed. The airport to a chamber 160 is formed in covering 159 in one. An airport is connected to the branching plate 66 through a by-path pipe 65, as shown in drawing 5.

[0045] Next, operation of the passage bulb in this example is explained.

[0046] Since the inside of a chamber 160 is maintained by atmospheric pressure during a halt of the air pump 61 which is an ink supply means and, as for the operation shaft of the valve 154 energized by the spring 153, the flexible film 157 and path clearance are maintained, the passage of ink is intercepted. A cross section shows the state at this time to drawing 6 (b).

[0047] Next, when an air pump 61 operates, the inside of a chamber 160 is pressurized and a diaphragm 158 receives an equal load with a pressure. This equal load serves as energization force according to the area of the pressure-receiving section 161, and a diaphragm 158 displaces, it minds flexible film 157 and is energized by the operation shaft of a valve 154, and a valve 154 resists the energization force of a spring 153, and moves up, and Kaisei of the passage is carried out. A cross section shows the state at this time to drawing 6 (c).

[0048] Therefore, on the occasion of the start of record operation, Kaisei of the passage is carried out only in operating an air pump 61, and ink circulation can be performed. Moreover, when record operation is completed, the passage between a recording head and an ink cartridge is intercepted by suspending an air pump 61.

[0049] Therefore, according to the above-mentioned composition, a bulb means can be operated according to the pressure of the supply means of ink, and according to this, ink can be stored in a sub tank also in a non-operating condition.

[0050] Moreover, it also has the effect that the passage bulb of two or more systems can be constituted in one, and can be constituted more cheaply.

[0051]

[Effect of the Invention] According to this invention, by arranging a bulb means in the passage between a recording head and an ink cartridge, ink can be made to store in a sub tank, and even if it therefore faces prolonged neglect, fixing of films and the blinding of passage can be prevented effectively.

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.....  
**TECHNICAL FIELD**  
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[The technical field to which invention belongs] this invention relates to the recording device which carries the ink-jet head which breathes out an ink drop and is made to adhere in the record paper, only when record is needed.

[0002] It is concerned with the ink-jet recording device of the circuit system which records while supplying ink to a sub tank and a recording head through passage from the ink cartridge which carried the ink-jet formula recording head and the sub tank in carriage, and was installed in the box in more detail.

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PRIOR ART

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[Description of the Prior Art] An ink-jet recording device carrying in carriage the \*\* ink-jet formula recording head which breathes out an ink drop by the pressure generating means, and printing receiving supply of ink from an ink tank, also carrying an ink cartridge in the carriage equipped with the recording head, and attaining simplification of structure is performed.

[0004] In order for dot density to become large by leaps and bounds with improvement in the performance of an ink-jet formula recording head, to, attain color printing by natural color on the other hand and to aim at improvement in much more printing quality, efforts to make the blot on a record medium small as much as possible are made.

[0005] Methods, such as heating and carrying out film formation of the emulsion which becomes ink from thermoplastics as the one means, and the ink which was made to contain sugar and was breathed out on a record medium, are proposed.

[0006] If it is in ink equipped with such film formation nature, since there are very few blots. since melting fixing of the emulsion in ink is carried out by heating in addition to the merit that quality of image improves sharply, while it has the merit that advanced water resistance is obtained, in order the concentration of the solid content under ink composition is high and to receive the thermal effect from a heating means further -- viscosity elevation of ink -- or it is easy to produce the unstable regurgitation by gassing accompanying a temperature up etc.

[0007] Although connecting a recording head, a sub tank, and an ink cartridge to endless, and circulating through ink as a method of canceling such a trouble is also proposed, since two passage of the passage for outward trips and the passage for return trips is needed between a recording head and an ink cartridge, it has the problem that passage structure becomes complicated. These people etc. are two common ink rooms which are open for free passage on both sides of the pressure room of a recording head. It has the ink feed hopper by which ink flows into the ink room of each community from the exterior, respectively. One ink feed hopper is connected to a sub tank, and the ink feed hopper of another side is connected to the ink cartridge. Make it go via an ink-jet formula recording head by the supply means of the ink which feeds the ink of an ink cartridge, and ink is pumped up on a sub tank. Moreover, the ink-jet recording device which was made to print while circulating through ink to an ink cartridge and making the interior of an adverse current, now a recording head circulate through ink via a sub tank to a recording head was proposed.

[0008] According to this, without causing complication of structure, the temperature up of the viscosity elevation by the recording head or a recording head can be prevented as much as possible, and stable record can be performed.

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**EFFECT OF THE INVENTION**

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[Effect of the Invention] According to this invention, by arranging a bulb means in the passage between a recording head and an ink cartridge, ink can be made to store in a sub tank, and even if it therefore faces prolonged neglect, fixing of films and the blinding of passage can be prevented effectively.

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**TECHNICAL PROBLEM**

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[Problem(s) to be Solved by the Invention] Since it can be circulated through a sub tank by constituting with a flexible film, without foaming also by vibration of the carriage further accompanying [ there is very little pressure fluctuation and ] record operation, it has the outstanding merit that record stabilized more can be performed.

[0010] However, in a non-operating condition, the ink in a sub tank will be in the state where films stuck through few ink layers in order to all flow backwards to an ink cartridge side according to a gravity difference. The technical problem that the ink of passage until the rise of the concentration of the solid content in remaining ink is remarkable when moisture evaporates through the aforementioned flexible film in neglect prolonged in this state etc., and films fix or it results [ from a sub tank ] in a head solidifies, and obstacles, such as jam up \*\*\*\*, arise occurs.

[0011] The place which this invention is made in view of such a technical problem, and is made into the purpose is offering the ink-jet recording device which an obstacle's does not produce by prolonged neglect, either by making ink remain in a sub tank also in the state where it does not work.

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MEANS

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[Means for Solving the Problem] Therefore, two common ink rooms which are open for free passage on both sides of a pressure generating room in this invention, The ink-jet formula recording head and sub tank which equipped the ink room of each aforementioned community with the ink feed hopper which connects with the exterior, respectively are carried in carriage. Moreover, it sets to the ink-jet recording device which comes to prepare the ink cartridge connected with the aforementioned ink-jet formula recording head by passage, and an ink supply means to feed the ink of the aforementioned ink cartridge, out of the aforementioned carriage. It is characterized by having a bulb means between a recording head and an ink cartridge.

[0013] Moreover, the aforementioned bulb means is characterized by being a normal closing type solenoid valve.

[0014] Moreover, the aforementioned bulb means is characterized by operating according to the pressure of an ink supply means to feed ink.

[0015] Furthermore, in a valve mechanism, an ink supply means to feed the aforementioned ink is an air pump, and it has the valve portion material arranged in the interior of the passage between the diaphragm connected with the aforementioned air pump in passage, and a recording head and an ink cartridge, and is characterized by interlocking with [ variation rate / of the aforementioned diaphragm ] the aforementioned valve portion material, and displacing.

[0016] Furthermore, the above-mentioned valve mechanism is characterized by arranging two or more valve portion material to a single diaphragm.

[0017]

[Embodiments of the Invention] Hereafter, the first example of this invention is explained using a drawing.

[0018] Drawing 1 shows the passage composition of the ink-jet recording device of this invention, and drawing 2 shows the structure of the ink-jet recording device of this invention. Moreover, drawing 3 and drawing 4 show structural drawing of a sub tank portion and an ink cartridge portion used for this invention, respectively.

[0019] In drawing 2, a recording head 1 and the sub tank unit 30 are stopped on carriage 2, and perform a both-way scan by the driving means which are not illustrated (horizontal scanning). The platen 10 arranged in the position which counters a recording head 1 on the other hand rotates by the driving means which are not illustrated, and, on the other hand, conveys in a direction the recording paper 12 which is a record medium (vertical scanning). Synchronizing with the above horizontal scanning and vertical scanning, based on record data, breathe out an ink drop, it is made to adhere on the recording paper 12, and predetermined record is performed from a recording head 1.

[0020] Water resistance is given while the blot by space is prevented because the front face of the emulsion which is thermoplastics contained in ink fuses and combines the ink drop recorded on the recording paper 12 while the moisture in ink evaporates quickly in response to the heat supply from the platen 10 heated at the heater 11 which is a heating means.

[0021] In addition to cooling by the ventilating fan which is not illustrated, this heat is cooled by what is made for ink to flow to the recording head 1 interior (ink circulation) although heat transfer is carried out also to the recording head 1 which faces a platen 10 at this time.

[0022] Next, drawing 1 explains the passage composition of the ink-jet recording device of this invention. Although this example is the composition of performing color record using the ink of four colors, it is the composition of branching the air from a single air pump to four lines, and performing ink circulation for every system, and shows only one only of lines of it by drawing 1.

[0023] 32 is a sub tank and is connected to a recording head 1. The recording head 1 is equipped with the ink feed hoppers 6 and 7 by which ink flows into two common ink rooms 4 and 5 which are open for free passage on both sides of the pressure room 3, and the ink room of each community from the exterior, respectively. According to the pressure differential from which the ink feed hopper 7 of another side is connected to the sub tank 32 side again at an ink cartridge 41 side, and one ink feed hopper 6 produces ink between ink rooms, a flow (ink circulation) is made via a pressure room.

[0024] The flexible supply tube 51 is connected to the ink feed hopper 7 by the side of a cartridge 41, and the passage bulb 52 which is a bulb means is connected to the other end of the supply tube 51. Opening of traffic of passage is made by energization to an internal solenoid, and the passage bulb 52 of this example consists of the so-called normal closing type which has the property that passage is intercepted in the state of un-energizing of solenoid valve.

[0025] The passage bulb 52 is further connected to an ink cartridge 41 via a tube 54 and the tubular needle 53.

[0026] Via the pressure regulator 62, the air pump 61 which is an ink supply means branches to four lines, and is connected to an ink cartridge 41 via the air pipe 64 from the change bulb 63.

[0027] Next, record operation is explained and it explains to a detail further.

[0028] While performing energization to the passage bulb 52 and carrying out Kaisei of the passage on the occasion of the start of

record operation, an air pump 61 is operated.

[0029] Circulation operation of ink is started based on the amount of ink in a sub tank henceforth.

[0030] The sub tank unit 30 shows the structure to drawing 3 by the exploded view. The sub tank 32 is made with the capacity adjustable using the flexible film. 141 is an ink full detector which detects the ink full of the sub tank 32, and 142 is an ink low detector which detects INKUEMPUTI. Ink full is detected when the amount of [ of the detection board 140 which is the tabular spring object arranged so that ink full might meet the front face of the sub tank 32 ] point intercepts the optical axis of the ink full detector 141 which consists of a photoluminescence photo-detector pair. Moreover, when the ink low detector 142 constituted the optical axis of a photoluminescence photo-detector pair on both sides of the sub tank 32, the ink of the sub tank 32 interior which has light-transmission nature decreased in number and the quantity of light to penetrate increased, ink empty \*\*\*\*\* of [ in a sub tank ] is carried out.

[0031] When the ink full of a sub tank is detected, the energization to the change bulb 63 is turned off by the control circuit which is not illustrated. They are three so-called directional valves as for which the change bulb 63 is opened for free passage by the cartridge side with the atmosphere while opening of traffic with an air pump 61 is made by energization and an air pump side is intercepted at the time of un-energizing. Therefore, atmospheric pressure is opened for free passage to the ink cartridge connected.

[0032] An ink cartridge 41 is the structure where the ink bag 43 is held in the airtight box 42, and the air pipe 64 is connected to the airport section of a box 42, as a cross section is shown in drawing 4 . Therefore, if the interior of a box 42 becomes atmospheric pressure, since the ink in the ink bag 43 will become equal to atmospheric pressure as much as possible, it has the water head difference shown by H in drawing 1 , and the ink in a sub tank flows backwards to a cartridge side via the inside of a recording head while being supplied to a recording head.

[0033] Next, when INKUEMPUTI of a sub tank is detected, the energization to the change bulb 63 is made, and the box 42 of an ink cartridge is opened for free passage with an air pump 61.

[0034] A pressure is adjusted so that ink may leak and it may not come out of the pressure from an air pump 61 by operation of the pressure regulator 62. Since the ink in the ink bag 43 is pressurized by this pressure, while the ink in the ink bag 43 is supplied to a recording head, it is pumped up via the inside of a recording head at a sub tank side.

[0035] Henceforth, ink circulation is made by repeating the above-mentioned operation successively during record operation.

[0036] The following operation is performed when a series of record operation is completed.

[0037] Energization to the change bulb 63 is performed first, ink is pumped up by the sub tank 32, when the ink full of a sub tank is detected, the energization to the passage bulb 52 is turned off, and the passage between a recording head and an ink cartridge is intercepted. Therefore, ink is stored inside the sub tank 32.

[0038] According to this, since ink sufficient in a sub tank remains also in prolonged future neglect, even if evaporation of the ink in a sub tank arises, solid-content concentration elevation is mitigated, and it is prevented effectively that blinding and films therefore fix.

[0039] Since passage is intercepted when a power supply is disconnected by the reason which is not power-failure-etc.-expected during record operation, since the passage bulb which is furthermore a bulb means consists of a normal closing type solenoid valve, operation that ink is held is in a sub tank.

[0040] Moreover, since the ink of the amount which corresponds in a sub tank at ink full is held when resuming record operation again, it also has the merit that record operation can be started immediately.

[0041] (others -- operation gestalt) drawing 5 shows the passage composition of the ink-jet recording device of the second example of this invention, and shows the structure of a bulb means to drawing 6

[0042] It explains using a drawing below.

[0043] Drawing 6 (a) is the exploded view having shown the composition of the passage bulb 52 used for this example.

[0044] In an example, four passage is arranged in a single unit and same operation is performed about each system. 154 is a valve, is energized with a spring 153 in the state of usual, and is pressed by packing 154 while a part for a shank is supported by casing 156 possible [ a slide ]. Fixation of a spring 153 and the free wheel plate 151 with a tube 51 which has the role of connection are fixed to the upper part of casing 156. Moreover, an end connection with the tube 54 which leads to an ink cartridge side is constituted by the casing 156 lower part in one. The flexible film 157 is arranged by casing 156 lower opening so that path clearance (c shows to drawing 6 (b)) may be constituted to the operation shaft of a valve 154. Although a flexible film can also use rubber etc., in this example, the flexible film used the laminate film which joined the polyethylene film which is thermoplastics further to the film which deposited aluminum on the PET film. It is more effective, when according to this it can join to casing 157 by heat welding and transparency of moisture or air carries out invasion prevention further. Although the passage of ink is formed of the above, since ink flows more nearly up than a lower part as pressurization shows all over [ a ] drawing, in order that a gas may not remain inside the passage bulb 52, it is suitable. Under the plasticity film 157, it consists of rubber material, covering 159 is arranged through the diaphragm 158 with which the pressure-receiving section 161 was formed in one, and a chamber 160 is formed. The airport to a chamber 160 is formed in covering 159 in one. An airport is connected to the branching plate 66 through a by-path pipe 65, as shown in drawing 5 .

[0045] Next, operation of the passage bulb in this example is explained.

[0046] Since the inside of a chamber 160 is maintained by atmospheric pressure during a halt of the air pump 61 which is an ink supply means and, as for the operation shaft of the valve 154 energized by the spring 153, the flexible film 157 and path clearance are maintained, the passage of ink is intercepted. A cross section shows the state at this time to drawing 6 (b).

[0047] Next, when an air pump 61 operates, the inside of a chamber 160 is pressurized and a diaphragm 158 receives an equal

load with a pressure. This equal load serves as energization force according to the area of the pressure-receiving section 161, and a diaphragm 158 displaces, it moves flexible film 157 and is energized by the operation shaft of a valve 154, and a valve 154 resists the energization force of a spring 153, and moves up, and Kaisei of the passage is carried out. A cross section shows the state at this time to drawing 6 (c).

[0048] Therefore, on the occasion of the start of record operation, Kaisei of the passage is carried out only in operating an air pump 61, and ink circulation can be performed. Moreover, when record operation is completed, the passage between a recording head and an ink cartridge is intercepted by suspending an air pump 61.

[0049] Therefore, according to the above-mentioned composition, a bulb means can be operated according to the pressure of the supply means of ink, and according to this, ink can be stored in a sub tank also in a non-operating condition.

[0050] Moreover, it also has the effect that the passage bulb of two or more systems can be constituted in one, and can be constituted more cheaply.

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[Translation done.]

**\* NOTICES \***

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1. This document has been translated by computer. So the translation may not reflect the original precisely.
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**DESCRIPTION OF DRAWINGS**

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**[Brief Description of the Drawings]**

[Drawing 1] Drawing showing the passage composition of the ink-jet recording device of the first example of this invention.

[Drawing 2] Drawing showing the structure of the ink-jet recording device of the first example of this invention.

[Drawing 3] Drawing showing the structure of the sub tank used for the first example of this invention.

[Drawing 4] The cross section of an ink cartridge used for the first example of this invention.

[Drawing 5] Drawing showing the passage composition of the ink-jet recording device of the second example of this invention.

[Drawing 6] Drawing explaining the composition of a bulb means by which it is used for the second example.

[Drawing 7] Drawing showing the composition of the conventional ink-jet recording device.

**[Description of Notations]**

1 : Recording Head

2 : Carriage

3 : Pressure Room

4 Five : Ink room

6 Seven : Feed hopper

10 : Platen

11 : Heater (Heating Means)

12 : Recording Paper (Record Medium)

32 : Sub Tank

41 : Ink Cartridge

51 : Supply Tube

52 : Passage Bulb (Bulb Means)

61 : Air Pump (Ink Supply Means)

154 : Valve

157 : Flexible Film

158 : Diaphragm

160 : Chamber

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**[Translation done.]**

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**CORRECTION or AMENDMENT**

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[Procedure amendment 1]

[Document to be Amended] Specification.

[Item(s) to be Amended] Whole sentence.

[Method of Amendment] Change.

[Proposed Amendment]

[Document Name] Specification.

[Title of the Invention] An ink-jet recording device and a valve mechanism.

[Claim(s)]

[Claim 1] In the ink-jet recording device which carries the ink-jet formula recording head which equipped two common ink rooms which are open for free passage on both sides of a pressure generating room, and the ink room of each aforementioned community with the ink feed hopper which connects with the exterior, respectively, and a sub tank unit in carriage, and arranges an ink cartridge out of the aforementioned carriage, and feeds the ink of the aforementioned ink cartridge to the aforementioned recording head through an ink feeder current way by the ink supply means

The ink-jet recording device which established a bulb means by which it consisted of a sub tank by which the aforementioned sub tank unit consists of a flexible film, and an ink full detector which detects the ink full of this sub tank, and the aforementioned sub tank could intercept the aforementioned ink feeder current way in the state of ink full.

[Claim 2] The ink-jet recording device according to claim 1 from which the aforementioned bulb means is constituted by the solenoid valve of normal closing form.

[Claim 3] The ink-jet recording device according to claim 1 to which the aforementioned bulb means operates according to the pressure of an ink supply means to feed ink.

[Claim 4] The valve mechanism of the ink-jet recording device according to claim 1 in which it is constituted with the air pump with which the aforementioned ink cartridge holds an ink bag in an airtight container, and is constituted, and the aforementioned ink supply means makes pneumatic pressure act on the aforementioned ink bag, and the aforementioned bulb means carries out switching action further with the pressure which acts on the aforementioned ink bag.

[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] this invention relates to the ink-jet recording device which records while supplying ink to a sub tank and a recording head cyclically through passage from the ink cartridge which carried the ink-jet formula recording head and the sub tank in carriage, and was installed in the box.

[0002]



[Description of the Prior Art] In order for dot density to become large by leaps and bounds with improvement in the performance of an ink-jet formula recording head, to attain color printing by natural color and to aim at improvement in much more printing quality, efforts to make the blot on a record medium small as much as possible are made. The emulsion which becomes ink from thermoplastics as the one means, and the method of heating and carrying out film formation of the ink which was made to contain sugar and was breathed out on a record medium are proposed.

[0003] If it is in ink equipped with such film formation nature, since there are very few blots. Since melting fixing of the emulsion in ink is carried out by heating in addition to the merit that quality of image improves sharply, while it has the merit that high water resistance is obtained, the concentration of the solid content under ink composition is high, in order to receive the heat from a heating means further, the viscosity of ink tends to rise and there is un-arranging [ that the \*\*\*\* property of ink becomes unstable with the air bubbles generated by the temperature up ].

[0004] Although connecting a recording head, a sub tank, and an ink cartridge to endless, and circulating through ink is also proposed in order to cancel such a trouble, since two passage of the passage for outward trips and the passage for return trips is needed between a recording head and an ink cartridge, it has the problem that passage structure becomes complicated. In order to solve such a problem, the re-official announcement No. 031335 [ 95 to ] official report sees. It has the ink feed hopper by which ink flows into two common ink rooms which are open for free passage on both sides of the pressure room of a recording head, and the ink room of each community from the exterior, respectively. One ink feed hopper is connected to a sub tank, and the ink feed hopper of another side is connected to the ink cartridge. Make the ink of an ink cartridge go via an ink-jet formula recording head, and ink is sent into a sub tank. Discharged the air bubbles of a recording head on the sub tank in this process, and the ink of the depths in which air bubbles do not exist was made to flow backwards from a sub tank to an ink cartridge via a recording head, ink was supplied to the recording head, and the ink-jet recording device printed while circulating ink was proposed. According to this, without causing complication of structure, the temperature up of the viscosity rise by the recording head or a recording head can be prevented as much as possible, and stable record can be performed.

[0005]

[Problem(s) to be Solved by the Invention] However, in order to perform record which absorbed the pressure fluctuation of the ink accompanying movement of carriage, and was stabilized, a sub tank fabricates a flexible film to a saccate, and is constituted. In order that the ink in a sub tank may flow backwards to an ink cartridge according to a gravity difference, i.e., a siphon phenomenon, by the non-operating condition on the other hand, It will be in the state where the films which constitute a sub tank stuck through the thin ink layer between long period of times. When it is further left in this state for a long period of time, moisture evaporates through the flexible film which constitutes a sub tank, films fix, and the ink of passage from a sub tank to the solid content of ink is condensed and ] a head solidifies, and there are problems, like clogging arises.

[0006] It is offering the ink-jet recording device which this invention's can be made in view of such a technical problem, and the place made into the purpose can make able to hold the ink of the amount which can be printed on a sub tank also in the state where it does not work, and can prevent the obstacle by prolonged neglect.

[0007]

[Means for Solving the Problem] In order to attain such a technical problem, it sets to this invention. In two common ink rooms which are open for free passage on both sides of a pressure generating room, and the ink room of each aforementioned community, each The ink-jet formula recording head equipped with the ink feed hopper linked to the exterior, In the ink-jet recording device which carries a sub tank unit in carriage, and arranges an ink cartridge out of the aforementioned carriage, and feeds the ink of the aforementioned ink cartridge to the aforementioned recording head through an ink feeder current way by the ink supply means A bulb means by which it consisted of a sub tank by which the aforementioned sub tank unit consists of a flexible film, and an ink full detector which detects the ink full of this sub tank, and the aforementioned sub tank could intercept the aforementioned ink feeder current way in the state of ink full was established.

[0008]

[Embodiments of the Invention] Then, based on the example illustrating the detail of this invention, it explains below. Drawing 2 shows one example of the recording device of this invention, a recording head 1 and the sub tank unit 30 are carried in carriage 2, and the driving means which are not illustrated perform a both-way scan (horizontal scanning). The platen 10 arranged in the position which counters a recording head 1 on the other hand rotates by the driving means which are not illustrated, and, on the other hand, conveys in a direction the recording paper 12 which is a record medium (vertical scanning). Synchronizing with the above horizontal scanning and vertical scanning, based on record data, breathe out an ink drop, it is made to adhere on the recording paper 12, and predetermined record is performed from a recording head 1.

[0009] Water resistance is raised while the blot by space is prevented because the front face of the emulsion which is thermoplastics contained in ink fuses and combines the ink drop recorded on the recording paper 12 while the moisture in ink evaporates quickly in response to the heat supply from the platen 10 heated at the heater 11 which is a heating means. Although heat transfer is carried out also to the recording head 1 which faces a platen 10 at this time, in addition to cooling by the ventilating fan which is not illustrated, this heat is cooled in the ink which flows ink to the recording head 1 interior.

[0010] Next, drawing 1 explains the passage composition of the ink-jet recording device of this invention. Although this example is the composition of performing color record using the ink of four colors, it is the composition of branching the air from a single air pump to four lines, and performing ink circulation for every system, and shows only one only of lines of it by drawing 1.

[0011] Two common ink rooms 4 and 5 which a recording head 1 opens for free passage on both sides of the pressure room 3, It has the ink feed hoppers 6 and 7 by which ink flows into the ink rooms 4 and 5 of each community from the exterior, respectively. The ink feed hopper 7 of another side is connected to the sub tank 32 by which one ink feed hopper 6 constitutes the sub tank unit

30 again at the ink cartridge 41, and ink flows cyclically via the pressure room 3 according to the pressure differential produced in the common ink rooms 4 and 5.

[0012] The flexible supply tube 51 is connected to the ink feed hopper 7 by the side of a cartridge 41, and the passage bulb 52 which is a bulb means is connected to the other end of the supply tube 51. Opening of traffic of passage is made by energization to an internal solenoid, and the passage bulb 52 of this example is constituted by the so-called normal closing type with which passage is intercepted in the state of un-energizing of solenoid valve.

[0013] The passage bulb 52 is further connected to an ink cartridge 41 via a tube 54 and the tubular needle 53. Via the pressure regulator 62, the air pump 61 which is an ink supply means branches to four lines, and is connected to the ink cartridge 41 via the air pipe 64 from the change bulb 63. According to such structure, it energizes on the passage bulb 52 at the time of the start of record operation, and passage is opened wide, and an air pump 61 is operated, and ink is cyclically supplied to a recording head 1 by things.

[0014] On the other hand, the sub tank unit 30 is equipped with the sub tank 32 constituted with the flexible film as shown in drawing 3, and volume changes with deformation of a film according to the amount of ink. The ink full detector 141 which detects ink full, and the ink low detector 142 which detects INKUEMPUT1 are formed in the sub tank 32. The ink full detector 141 consists of photoluminescence photo-detector pairs. A detecting signal is outputted when the detection board 140 which is the tabular spring object arranged so that the front face of the sub tank 32 might be met intercepts an optical axis. moreover, the ink low detector 142 The \*\*\*\*\* photoluminescence photo-detector pair constitutes the sub tank 32, and when the ink of the sub tank 32 which has light-transmission nature decreased in number and the quantity of light to penetrate increased, it is constituted so that a signal may be outputted.

[0015] When the ink full of the sub tank 30 is detected, the energization to the change bulb 63 is turned off by the control circuit which is not illustrated. as three so-called directional valves by which the change bulb 63 is opened for free passage by energization with an air pump 61, a free passage with an air pump 61 is intercepted, and a cartridge 41 is further opened for free passage with the atmosphere at the time of un-energizing -- composition -- now, it is

[0016] As an ink cartridge 41 is shown in drawing 4, the ink bag 43 is held in the airtight box 42, and the air pipe 64 is connected to the airport section of a box 42. Thereby, if the interior of a box 42 becomes atmospheric pressure, the ink in the ink bag 43 will flow backwards to a cartridge 41 via a recording head 1 while the ink of the sub tank 30 is supplied to a recording head 1 with the water head difference H shown in drawing 1, since it becomes equal to atmospheric pressure as much as possible.

[0017] Next, if detected by the ink empty \*\* ink low detector 142 of the sub tank 32, the energization to the change bulb 63 will be made and the box 42 of an ink cartridge 41 will be opened for free passage by the air pump 61. A pressure is adjusted so that ink may leak with the pressure regulator 62 and it may not come out of the pressure from an air pump 61. The ink in the ink bag 43 is pressurized by this pressure, and the ink of the ink bag 43 is supplied to a recording head 1 through the supply tube 51, and is supplied also to the sub tank 32 via here. And if the ink full of the sub tank 32 is detected by the ink full detector 141, the energization to the change bulb 63 will be severed and supply of ink will stop. Henceforth, during record operation, the above-mentioned operation winds based on the signal from detectors 141 and 142, and \*\*\*\*\* Inc. is supplied cyclically.

[0018] On the other hand, when record operation is completed, it energizes on the change bulb 63, ink is pumped up on the sub tank 32 and the ink full of the sub tank 32 is detected, energization of the passage bulb 52 is turned off. This intercepts the passage where the passage bulb 52 connects a recording head 1 and an ink cartridge 41. The ink with which the siphon phenomenon by the water head difference H of the sub tank 32 and an ink cartridge 41 was prevented, and the sub tank 32 was filled up by this stagnates on the sub tank 32, without flowing backwards to an ink cartridge 41.

[0019] According to this, since the ink of an ink full EQC remains on the sub tank 32 also in prolonged future neglect, even if the sub tank 32's arises, solid-content concentration elevation is mitigated, and it is prevented effectively that blinding and films therefore fix.

[0020] Since passage is intercepted when a power supply is disconnected by the reason which is not power-failure-etc.-expected during record operation, since the passage bulb which is furthermore a bulb means consists of a normal closing type solenoid valve, operation that ink is held is in a sub tank.

[0021] Moreover, since the ink of the amount which corresponds in a sub tank at ink full is held when resuming record operation again, it also has the merit that record operation can be started immediately.

[0022] Drawing 5 shows the second example of the ink-jet recording device of this invention, and the valve in which an air drive is possible constitutes passage bulb 52' prepared in the ink supply tube 51 in this example.

[0023] Drawing 6 (a) shows one example of passage bulb 52', and is arranging four passage in a single unit in an example, and each system operates similarly. It is a valve 154, and while a part for a shank is supported by casing 156 possible [ a slide ], in the state of usual, it is energized with a spring 153, and is pressed by packing 154. Fixation of a spring 153 and the free wheel plate 151 with a tube 51 which has the role of connection are fixed to the upper part of casing 156. Moreover, an end connection with the tube 54 which leads to an ink cartridge side is constituted by the casing 156 lower part in one.

[0024] The flexible film 157 is arranged by lower opening of casing 156 so that path clearance (c shows to drawing 6 (b)) may be formed to the operation shaft of a valve 154. Although the flexible film 157 is possible also for using rubber etc., in this example, the laminate film which joined the polyethylene film which is thermoplastics further to the film with which the flexible film deposited aluminum on the PET film is used. It is more effective, when according to this example the flexible film 157 can be joined to casing 157 by heat welding and transparency of moisture or air carries out invasion prevention further.

[0025] In addition, since ink flows up as the arrow a of drawing 6 (a) shows by pressurization, a gas remains and is suitable for it to the interior of the passage bulb 52. Under the plasticity film 157, it consists of rubber material, covering 159 is arranged

through the diaphragm 158 with which the pressure-receiving section 161 was formed in one, and a chamber 160 is formed. The airport to a chamber 160 is formed in covering 159 in one, and as shown in drawing 5, it connects with the branching plate 66 through the by-path pipe 65.

[0026] In this example, the inside of a chamber 160 is maintained by atmospheric pressure during a halt of an air pump 61, and since the flexible film 157 and path clearance were maintained, as the operation shaft of the valve 154 energized by the spring 153 was shown in drawing 6 (b), the passage of ink is intercepted.

[0027] If an air pump 61 is operated, the inside of a chamber 160 will be pressurized and a diaphragm 158 will receive an equal load with a pressure. This equal load serves as energization force according to the area of the pressure-receiving section 161, a diaphragm 158 displaces, and it is energized by the operation shaft of a valve 154 through the flexible film 157, and a valve 154 resists the energization force of a spring 153, and moves up, and as shown in drawing 6 (c), Kaisei of the passage is carried out.

[0028] Therefore, Kaisei of the passage is carried out only in operating an air pump 61 at the time of the start of record operation, and ink circulation is performed. Moreover, when record operation is completed, by stopping an air pump 61, the ink feeder current way 51 which connects an ink cartridge 41 with a recording head 1 can be blockaded, and suppose un-working in the state where the sub tank 32 was made to store ink for a long period of time.

[0029]

[Effect of the Invention] Two common ink rooms which are open for free passage on both sides of a pressure generating room according to this invention, In the ink room of each community, each The ink-jet formula recording head equipped with the ink feed hopper linked to the exterior, In the ink-jet recording device which carries a sub tank unit in carriage, and arranges an ink cartridge out of carriage, and feeds the ink of an ink cartridge to a recording head through an ink feeder current way by the ink supply means It consists of a sub tank by which a sub tank unit consists of a flexible film, and an ink full detector which detects the ink full of a sub tank. Moreover, since a bulb means by which a sub tank could intercept an ink feeder current way in the state of ink full was established, the state where the sub tank was filled up with the ink of the amount of conventions can be maintained for a long period of time, and it can prevent that the ink of a sub tank solidifies also by prolonged neglect.

[Brief Description of the Drawings]

[Drawing 1] It is drawing showing the passage composition which shows one example of the ink-jet recording device of this invention.

[Drawing 2] It is drawing showing one example of the ink-jet recording device of this invention.

[Drawing 3] It is the assembly perspective diagram showing one example of the sub tank of a recording device same as the above.

[Drawing 4] It is the cross section showing one example of the ink cartridge of a recording device same as the above.

[Drawing 5] It is the passage block diagram showing the second example of this invention.

[Drawing 6] Drawing (a) Or (c) is the assembly perspective diagram and cross section showing one example of the bulb means of a recording device same as the above, respectively.

[Description of Notations]

1 Recording head.

2 Carriage.

3 Pressure room.

4 5 Common ink room.

6 Seven Ink feed hopper.

10 Platen.

30 Sub tank unit.

32 Sub tank.

41 Ink cartridge.

51 Supply tube.

52 Passage Bulb (Bulb Means)

61 Air Pump (Ink Supply Means)

[Procedure amendment 2]

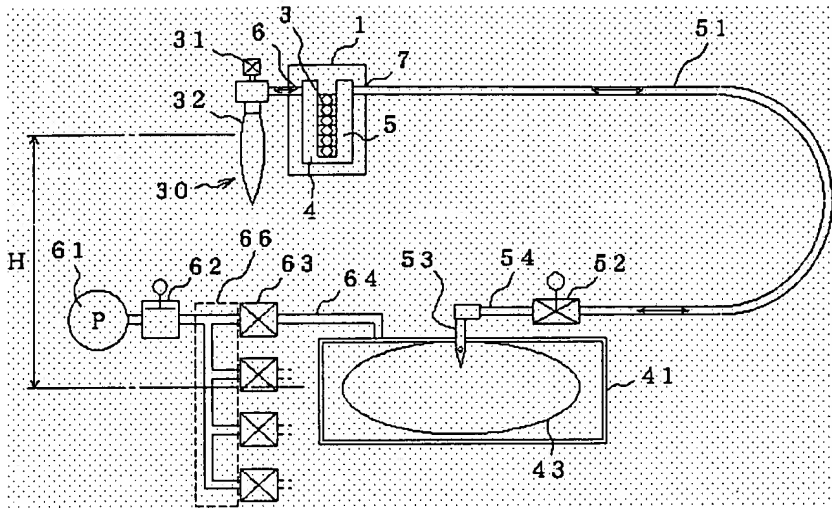
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[Item(s) to be Amended] Drawing 1.

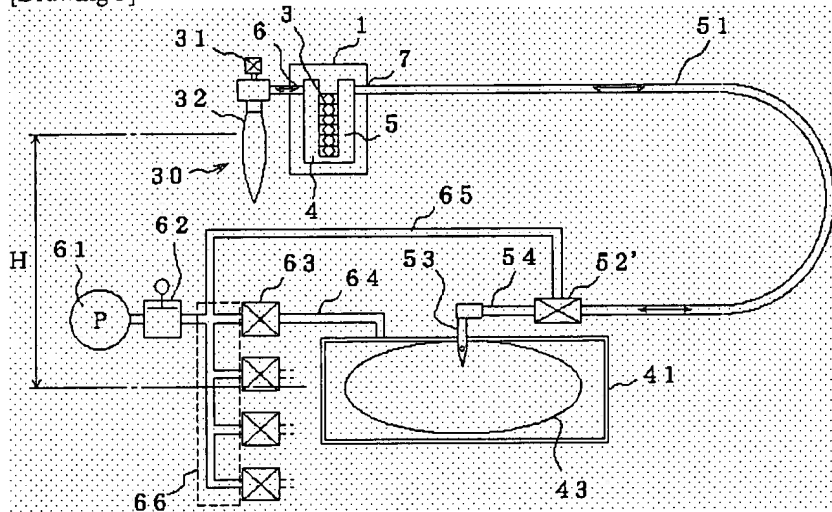
[Method of Amendment] Change.

[Proposed Amendment]

[Drawing 1]



[Procedure amendment 3]  
 [Document to be Amended] DRAWINGS  
 [Item(s) to be Amended] Drawing 5.  
 [Method of Amendment] Change.  
 [Proposed Amendment]  
 [Drawing 5]



[Procedure amendment 4]  
 [Document to be Amended] DRAWINGS  
 [Item(s) to be Amended] Drawing 7.  
 [Method of Amendment] Deletion.

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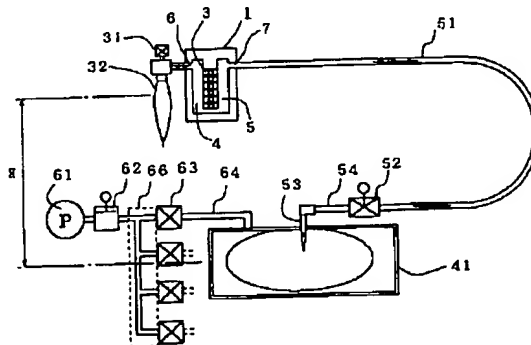
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(54)【発明の名称】 インクジェット記録装置およびバルブ機構

(57)【要約】

【課題】 循環方式のインクジェット記録装置において、長期間の放置に於いてもサブタンクフィルムの固着や流路目詰まり等の障害を防止し信頼性の高いインクジェット記録装置を提供する。

【解決手段】 カートリッジ41側のインク供給口7には可撓性の供給チューブ51が接続され、供給チューブ51の他端にはバルブ手段である流路バルブ52が接続されている。流路バルブ52は、さらにチューブ54、管状針53を経由してインクカートリッジ41に接続されている。インク供給手段である空気ポンプ61は圧力レギュレータ62を経由し、4系統に分岐され、切替バルブ63からエアパイプ64を経由してインクカートリッジ41に接続されている。



## 【特許請求の範囲】

【請求項1】 圧力発生室の両側に連通する2つの共通のインク室と、前記各共通のインク室にそれぞれ外部と接続するインク供給口を備えたインクジェット式記録ヘッドとサブタンクとをキャリッジに搭載し、また前記キャリッジ外に前記インクジェット式記録ヘッドと流路により接続するインクカートリッジと、前記インクカートリッジのインクを圧送するインク供給手段とを設けてなるインクジェット記録装置において、

記録ヘッドとインクカートリッジの間にバルブ手段を有することを特徴とする、インクジェット記録装置。 10

【請求項2】 前記バルブ手段が、ノーマルクローズタイプの電磁弁であることを特徴とする請求項1記載のインクジェット記録装置。

【請求項3】 前記バルブ手段が、インクを圧送するインク供給手段の圧力に応じて動作することを特徴とする請求項1記載のインクジェット記録装置。

【請求項4】 前記インクを圧送するインク供給手段が空気ポンプであり、前記空気ポンプと流路で接続されたダイアフラムと、記録ヘッドとインクカートリッジの間の流路内部に配設された弁部材を有し、前記弁部材が前記ダイアフラムの変位と連動して変位することを特徴とする請求項3記載のインクジェット記録装置のバルブ機構。 20

【請求項5】 単一のダイアフラムに対し、複数の弁部材を配設したことを特徴とする請求項4記載のバルブ機構。

## 【発明の詳細な説明】

## 【0001】

【発明の属する技術分野】本発明は、記録を必要とする時にのみインク滴を吐出して記録紙上に付着させるインクジェットヘッドを搭載する記録装置に関する。 30

【0002】さらに詳しくは、インクジェット式記録ヘッドとサブタンクをキャリッジに搭載し、また函体に設置されたインクカートリッジから流路を介してサブタンクと記録ヘッドにインクを供給しながら記録を行う循環方式のインクジェット記録装置に関わる。

## 【0003】

【従来の技術】インクジェット記録装置は、圧力発生手段によりインク滴を吐出するインクジェット式記録ヘッドをキャリッジに搭載して、インクタンクからインクの補給を受けながら印刷を行うもので、記録ヘッドを備えたキャリッジにインクカートリッジをも搭載して、構造の簡素化を図ることが行われている。 40

【0004】一方、インクジェット式記録ヘッドの性能の向上に伴ってドット密度が飛躍的に大きくなり、天然色でのカラー印刷が可能となり、より一層の印刷品質の向上を図るため、記録媒体上での滲みを可及的に小さくする努力がなされている。

【0005】その一つ的手段としてインクに熱可塑性樹 50

脂からなるエマルジョンや、糖を含有させて、吐出したインクを記録媒体上で加熱して造膜させる等の方法が提案されている。

【0006】このような造膜性を備えたインクにあつては、滲みが非常に少ないため画質が大幅に向上するといったメリットに加え、加熱によりインク中のエマルジョンが溶融定着されるため、高度の耐水性が得られるといったメリットを有する一方、インク組成中の固形分の濃度が高く、さらに加熱手段からの熱影響を受けるため、インクの粘度上昇や、あるいは昇温に伴う気泡発生等による不安定吐出を生じやすい。

【0007】このような問題点を解消する方法として、記録ヘッド、サブタンク、及びインクカートリッジをエンドレスに接続してインクを循環することも提案されているが、記録ヘッドとインクカートリッジとの間に往路用の流路と復路用の流路との2つの流路を必要とするため、流路構造が複雑になるという問題を抱えている。本出願人等は、記録ヘッドの圧力室の両側に連通する2つの共通のインク室と、各共通のインク室にそれぞれ外部からインクが流入するインク供給口とを備え、一方のインク供給口がサブタンクに、また他方のインク供給口がインクカートリッジに接続されていて、インクカートリッジのインクを圧送するインクの供給手段によりインクジェット式記録ヘッドを経由させてサブタンクにインクを汲み上げ、またサブタンクから記録ヘッドを経由してインクカートリッジにインクを逆流させて記録ヘッドの内部にインクを循環させながら印刷を行うようにしたインクジェット記録装置を提案した。

【0008】これによれば、構造の複雑化を招くことなく、記録ヘッドでの粘度上昇や記録ヘッドの昇温を可及的に防止することが出来、安定した記録が行える。

## 【0009】

【発明が解決しようとする課題】サブタンクは可撓性膜により構成することにより、圧力変動が極めて少なく、さらに記録動作に伴うキャリッジの振動によっても発泡することなく循環を行えるため、より安定した記録ができるといった優れたメリットがある。

【0010】しかしながら、非稼働状態ではサブタンク内のインクは重力差によりインクカートリッジ側に逆流し尽くすため、フィルム同士がわずかなインク層を介して密着した状態となる。この状態で長期間の放置等で前記可撓性膜を通して水分が蒸発した際には残留しているインク中の固形分の濃度の上昇が著しく、フィルム同士が固着されたり、サブタンクからヘッドに至るまでの流路のインクが固化して目詰まる等の障害が生じるという課題がある。

【0011】本発明はこのような課題に鑑みてなされたものであって、その目的とするところは、非稼働の状態においてもサブタンク内にインクを残留せしめることにより、長期間の放置によっても障害の生じることの無

い、インクジェット記録装置を提供することである。

【0012】

【課題を解決するための手段】そのために本発明においては、圧力発生室の両側に連通する2つの共通のインク室と、前記各共通のインク室にそれぞれ外部と接続するインク供給口を備えたインクジェット式記録ヘッドとサブタンクとをキャリッジに搭載し、また前記キャリッジ外に前記インクジェット式記録ヘッドと流路により接続するインクカートリッジと、前記インクカートリッジのインクを圧送するインク供給手段とを設けてなるインク

ジェット記録装置において、記録ヘッドとインクカートリッジの間にバルブ手段を有することを特徴とする。

【0013】また、前記バルブ手段が、ノーマルクローズタイプの電磁弁であることを特徴とする。

【0014】また、前記バルブ手段が、インクを圧送するインク供給手段の圧力に応じて動作することを特徴とする。

【0015】さらに、バルブ機構において、前記インクを圧送するインク供給手段が空気ポンプであり、前記空気ポンプと流路で接続されたダイアフラムと、記録ヘッドとインクカートリッジの間の流路内部に配設された弁部材を有し、前記弁部材が前記ダイアフラムの変位と連動して変位することを特徴とする。

【0016】さらに、上記バルブ機構は、単一のダイアフラムに対し、複数の弁部材を配設したことを特徴とする。

【0017】

【発明の実施の形態】以下、図面を用いて本発明の第一実施例を説明する。

【0018】図1は本発明のインクジェット記録装置の流路構成を示し、図2は本発明のインクジェット記録装置の構造を示す。また、図3、図4はそれぞれ本発明に用いられるサブタンク部分、インクカートリッジ部分の構造図を示している。

【0019】図2において、記録ヘッド1およびサブタンクユニット30は、キャリッジ2上に係止され、図示しない駆動手段により往復走査を行う（主走査）。一方、記録ヘッド1に対向する位置に配設されたプラテン10は図示しない駆動手段により回転され、記録媒体である記録紙12を一方方向に搬送する（副走査）。以上の主走査および副走査に同期して、記録データに基づいて記録ヘッド1よりインク滴を吐出し、記録紙12上に付着させて所定の記録を行う。

【0020】記録紙12上に記録されたインク滴は加熱手段であるヒータ11により加熱されたプラテン10からの熱供給を受けてインク中の水分が急速に蒸発されるとともに、インク中に含まれる熱可塑性樹脂であるエマルジョンの表面が溶融し結合することで紙面への滲みが防止されるとともに耐水性が付与される。

【0021】このとき、プラテン10に相対する記録ヘ

ッド1にも伝熱されるが、この熱は図示しない排気ファンによる冷却に加えて、記録ヘッド1内部にインクを流動させる（インク循環）ことにより冷却される。

【0022】次に本発明のインクジェット記録装置の流路構成を図1により説明する。本実施例は、4色のインクを用いてカラー記録を行う構成であるが、単一の空気ポンプからの空気を4系統に分岐し各系統毎にインク循環を行う構成であり、図1ではそのうちの1系統のみを示している。

【0023】32はサブタンクであり、記録ヘッド1に接続される。記録ヘッド1は圧力室3の両側に連通する2つの共通のインク室4、5と、各共通のインク室にそれぞれ外部からインクが流入するインク供給口6、7を備えている。一方のインク供給口6はサブタンク32側に、また他方のインク供給口7がインクカートリッジ41側に接続され、インクはインク室間に生ずる圧力差に応じて圧力室を経由して流動（インク循環）がなされる。

【0024】カートリッジ41側のインク供給口7には可撓性の供給チューブ51が接続され、供給チューブ51の他端にはバルブ手段である流路バルブ52が接続される。本実施例の流路バルブ52は内部のソレノイドへ通電により流路の開通がなされ、非通電状態では流路が遮断される特性を有する、いわゆるノーマルクローズタイプの電磁弁からなる。

【0025】流路バルブ52はさらにチューブ54、管状針53を経由してインクカートリッジ41に接続される。

【0026】インク供給手段である空気ポンプ61は圧力レギュレータ62を経由し、4系統に分岐され、切替バルブ63からエアパイプ64を経由してインクカートリッジ41に接続される。

【0027】次に、記録動作について説明を行い、さらに詳細に説明する。

【0028】記録動作の開始に際しては、流路バルブ52への通電を行い流路を開成せしめるとともに空気ポンプ61を動作させる。

【0029】以降はサブタンク内のインク量を基にインクの循環動作を開始する。

【0030】サブタンクユニット30は図3にその構造を分解図により示す。サブタンク32は可撓性フィルムを用いて容量可変となしている。141はサブタンク32のインクフルを検知するインクフル検出器であり、142はインクエンプティーを検出するインクロー検出器である。インクフルはサブタンク32の表面に沿うように配設された板状バネ体である検出板140の先端部分が光受光素子対からなるインクフル検出器141の光軸を遮断した場合にインクフルが検知される。また、インクロー検出器142はサブタンク32を挟んで光受光素子対の光軸を構成し、光透過性を有するサブタ

ンク32内部のインクが減少し、透過する光量が増加したことにより、サブタンク内のインクエンパティが検知される。

【0031】サブタンクのインクフルが検出された場合には図示しない制御回路により切替バルブ63への通電がOFFされる。切替バルブ63は通電によりエアポンプ61との開通がなされ、非通電時には、空気ポンプ側が遮断されるとともに、カートリッジ側は大気と連通されるいわゆる3方向弁である。よって接続されるインクカートリッジ側は大気圧が連通される。

【0032】インクカートリッジ41は図4に断面図を示すように、気密性の函体42にインク袋43が収容され、函体42の空気口部にエアパイプ64が接続される構造である。よって函体42の内部が大気圧になると、インク袋43中のインクは可及的に大気圧と等しくなるため、図1にHで示す水頭差をもって、サブタンク内のインクは記録ヘッドに供給されるとともに記録ヘッド内を経由してカートリッジ側に逆流される。

【0033】次に、サブタンクのインクエンパティを検出した場合には切替バルブ63への通電がなされ、インクカートリッジの函体42は空気ポンプ61と連通される。

【0034】空気ポンプ61からの圧力は圧力レギュレータ62の作用により、インクが漏れ出たりしないように圧力が調整される。この圧力によりインク袋43内のインクは加圧されるため、インク袋43中のインクが記録ヘッドに供給されるとともに、記録ヘッド内を経由してサブタンク側に汲み上げられる。

【0035】以降、記録動作中に上記動作を順次繰り返すことでインク循環がなされる。

【0036】一連の記録動作が終了した場合には、以下の動作が行われる。

【0037】まず切替バルブ63への通電を行いサブタンク32にインクを汲み上げられ、サブタンクのインクフルが検出された時点で流路バルブ52への通電がOFFされ、記録ヘッドとインクカートリッジ間の流路が遮断される。よって、サブタンク32の内部にはインクが貯留される。

【0038】これによれば、以後の長期間の放置に於いてもサブタンク内に十分なインクが残留されるのでサブタンク内のインクの蒸発が生じて固形分濃度上昇が軽減され、よって目詰まりやフィルム同士が固着したりすることが効果的に防止される。

【0039】さらにバルブ手段である流路バルブがノーマルクローズタイプの電磁弁よりなるため、記録動作中に停電等予期せぬ事由により、電源が切断された場合においても、流路が遮断されるためにサブタンク内にはインクが保持されるという作用がある。

【0040】また、再び記録動作を再開する場合にもサブタンク内にはインクフルに相当する量のインクが保持

されているため、即時に記録動作を開始することができるといったメリットも有する。

【0041】(他の実施形態)図5は、本発明の、第二の実施例のインクジェット記録装置の流路構成を示し、バルブ手段の構造を図6に示す。

【0042】以下図面を用いて説明を行う。

【0043】図6(a)は本実施例に用いる流路バルブ52の構成を示した分解図である。

【0044】実施例に於いては、4系統の流路を単一のユニット内に配設しており、それぞれの系統については同様の動作が行われる。154は弁であり、軸部分がケーシング156にスライド可能に支持されると共に、平常状態ではバネ153により付勢されてバックリング154に押圧される。ケーシング156の上部にはバネ153の固定及びチューブ51との接続の役を有するフタ151が固定される。またケーシング156下部にはインクカートリッジ側に通じるチューブ54との接続口が一体的に構成される。ケーシング156下部開口部には弁154の作動軸に対しクリアランス(図6(b)にcで示す)を構成するように可撓性膜157が配設される。可撓性膜はゴム等を用いることも可能であるが、本実施例においては、可撓性膜はPETフィルムにアルミニウムを蒸着したフィルムに、さらに熱可塑性樹脂であるポリエチレンフィルムを接合したラミネートフィルムを用いた。これによれば、ケーシング157に熱溶着により接合でき、さらに、水分の透過、あるいは空気の侵入防止する上でより効果的である。以上によりインクの流路が形成されるが、インクは加圧により図中aで示すように下方より上方に流動するため、流路バルブ52の内部に気体が残留しないため好適である。可撓性膜157の下方には、ゴム材からなり、受圧部161が一体的に形成されたダイアフラム158を介してカバー159が配設され、チャンバー160を形成する。カバー159には、チャンバー160への空気口が一体的に形成される。空気口は図5に示す様にバイパス管65を介して分岐プレート66に接続される。

【0045】次に本実施例における流路バルブの動作を説明する。

【0046】インク供給手段である空気ポンプ61の停止中においてはチャンバー160内は大気圧に維持され、バネ153に付勢された弁154の作動軸は可撓性膜157とクリアランスが維持されるためにインクの流路は遮断される。このときの状態を図6(b)に断面図で示す。

【0047】次に空気ポンプ61が作動した場合には、チャンバー160内が加圧され、ダイアフラム158は圧力により均等加重を受ける。この均等加重は受圧部161の面積に応じて付勢力となりダイアフラム158が変位し、可撓性膜157を介して弁154の作動軸に付勢され、弁154はバネ153の付勢力に抗して上方に移



動し、流路が開成される。このときの状態を図6(c)に断面図で示す。

【0048】従って、記録動作の開始に際しては空気ポンプ61を動作するのみで流路が開成され、インク循環が行える。また記録動作が終了した場合には、空気ポンプ61を停止することで記録ヘッドとインクカートリッジの間の流路が遮断される。

【0049】よって上記構成によれば、インクの供給手段の圧力に応じてバルブ手段が動作でき、これによれば、非稼働状態においてもインクをサブタンクに貯留することができる。

【0050】また、複数の系統の流路バルブを一体的に構成でき、より安価に構成することが出来るという効果も有する。

【0051】

【発明の効果】本発明によれば、記録ヘッドとインクカートリッジの間の流路にバルブ手段を配設することにより、サブタンク内にインクを貯留せしめることができ、よって長期間の放置に際してもフィルム同士の固着や流路の目詰まりを効果的に防止することが出来る。

【図面の簡単な説明】

【図1】本発明の第一実施例のインクジェット記録装置の流路構成を示す図。

【図2】本発明の第一実施例のインクジェット記録装置の構造を示す図。

【図3】本発明の第一実施例に用いられるサブタンクの構造を示す図。

【図4】本発明の第一実施例に用いられるインクカートリッジの断面図。

【図5】本発明の第二実施例のインクジェット記録装置の流路構成を示す図。

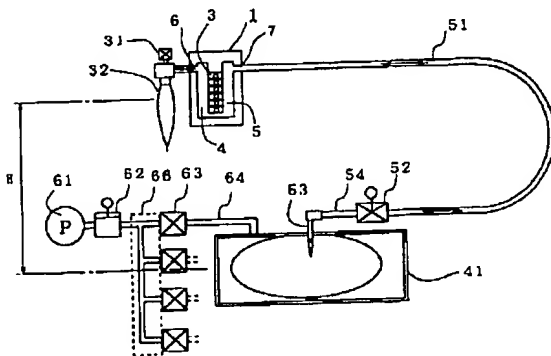
【図6】第二実施例に用いられるバルブ手段の構成を説明する図。

【図7】従来のインクジェット記録装置の構成を示す図。

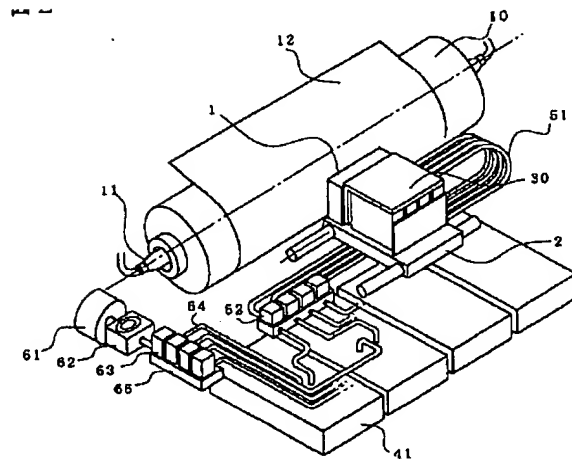
【符号の説明】

1	: 記録ヘッド
2	: キャリッジ
3	: 圧力室
4, 5	: インク室
6, 7	: 供給口
10	: プラテン
11	: ヒータ (加熱手段)
12	: 記録紙 (記録媒体)
32	: サブタンク
41	: インクカートリッジ
51	: 供給チューブ
52	: 流路バルブ (バルブ手段)
61	: 空気ポンプ (インク供給手段)
154	: 弁
157	: 可撓性膜
158	: ダイアフラム
160	: チャンバー

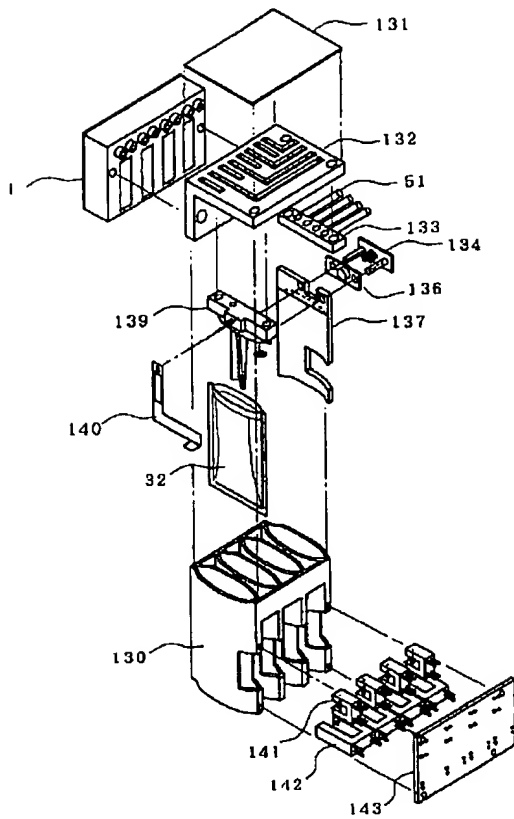
【図1】



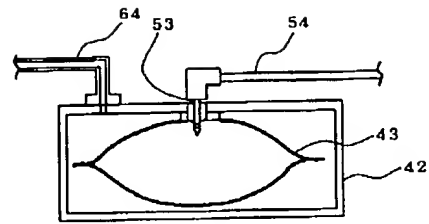
【図2】



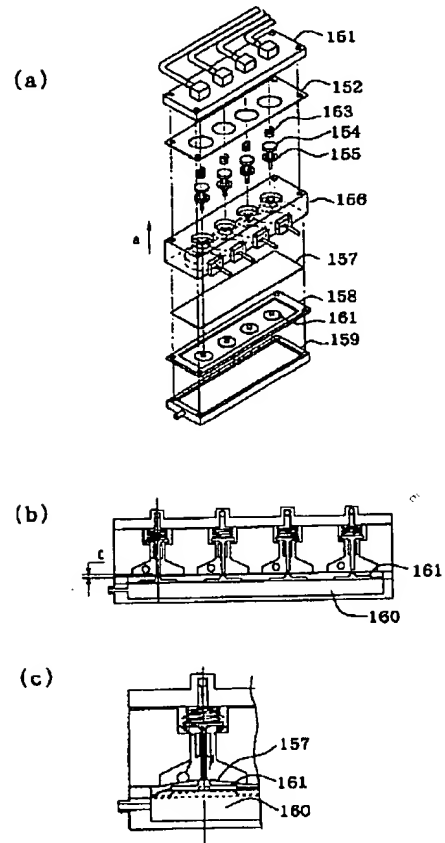
【図3】



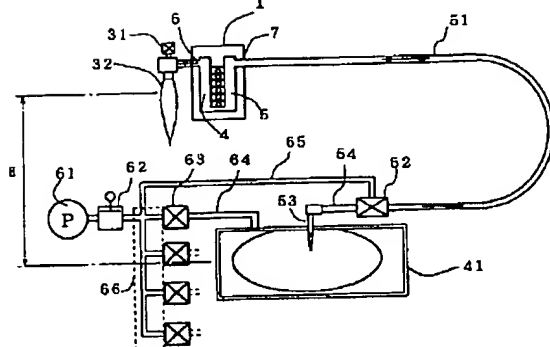
【図4】



【図6】



【図5】



【図7】

